Mothers' Use of Inferential Language and Preschoolers' Narrative Comprehension

Research Thesis

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Abstract

The purpose of the current study is to examine mothers' inferential language during a shared book-reading activity and their preschoolers' later vocabulary, story comprehension and spontaneous production of inferences in a 6-month longitudinal study. All extratextual utterances were coded according to 4 levels of abstraction, which organized utterances by literal and inferential language. Inferential language was further coded into categories to examine the possibility that the t*ype* of inferences mothers make (e.g., causal) predict children's inferences within the same task as well as children's independent production of inferences. Results showed that mother's inferences correlate with children's story comprehension. Children's story comprehension also correlated with their own vocabulary scores. Mother's open-ended questions correlate with children's elaborative responses and mother's closed questions correlate with children's yes/no responses during shared book reading. Additionally, all categories of inferences were significantly correlated between the mother and her child during shared reading. However, mothers' inference categories did not predict children's later inference categories made on their own. Mother's use of inferential language predicted preschoolers' vocabulary 6 months later and her use of level 2 language about character actions was correlated to her child's. Understanding how parent-child interactions are related to preschoolers' story comprehension has practical implications, considering the relationship between inference making and later reading comprehension skills.

Mothers' Use of Inferential Language and Preschooler's Narrative Comprehension

A major goal – perhaps the ultimate goal – of educators is to promote children's reading comprehension because it is a foundational skill necessary for virtually all academic progress in any field of study. According to The National Center for Education Statistics [NCES], 33% of American fourth graders in 2010 and 25% of eighth graders in 2009 scored below basic reading comprehension levels. In light of these staggering statistics, some claim that there is a reading crisis in America's schools today. Van Kleeck (2008) states that individual differences in literacy skills appear to be in place around age 4 (before a child starts school) and tend to stay that way. Because early literacy skills predict later reading comprehension, studying pre-readers' narrative comprehension is extremely relevant (e.g., Kendeou, van den Broek, White, & Lynch, 2009). Several researchers have argued that comprehension of text prior to kindergarten should be termed "narrative comprehension" (i.e., comprehension of stories prior to reading on one's own) as opposed to "reading comprehension" (e.g., Griffin, Hemphill, Camp, & Wolf, 2004).

Central to narrative/reading comprehension is the ability to engage in inferencing, or going beyond the text to fill in information not explicitly stated. Examples of inferences include: making comparisons and judgments, making predictions, and offering explanations that go beyond the story. Inferences are often examined in relation to literal utterances, which focus on basic perceptual aspects of the story (e.g., pointing, labeling). Several researchers have found that adults' use of inferential language is related to young children's later reading comprehension (e.g., van Kleeck, Gillam, Hamilton, & McGrath, 1997). Intervention studies also suggest a causal link between adults' inferential language and children's language skills (e.g., van Kleeck, Woude, & Hammett, 2006). At the same time, previous research shows that children who have

difficulties with comprehension also show poor inferential skills (e.g., Cain & Oakhill, 1999).

Several researchers have found that school-aged children's ability to produce inferences about a story is related to their comprehension of the same story (e.g., Kendeou, Bohn-Gettler, White, & van den Broek, 2008). For the purpose of this project, "story comprehension" refers to children's ability to answer questions about a story as it is presented by an adult. Recently, Tompkins, Guo, and Justice (2013) found that this relationship between inference generation and story comprehension is evident in preschoolers as well. They found that preschoolers could spontaneously produce inferences while narrating a wordless book and that the more inferences preschoolers made, the greater their comprehension of a different book read by an experimenter.

Although preschoolers have the ability to think at an abstract level, their production of inferences is less likely than older children unless prompted or questioned by an adult (Oakhill & Cain, 2003). This highlights the importance of the adult's role in scaffolding young children's language development. In their analysis of adult-child verbal interactions, Danis, Bernard and Leproux (2000) found that preschoolers were unlikely to raise the conversation to higher levels of abstraction within a shared book-reading, but when adults transitioned to more complex language, the children adjusted accordingly.

One study suggested that, among preschoolers with learning impairments, sharing books with embedded questions that target both literal and inferential language skills can result in gains in these skills (van Kleeck, et al., 2006). In fact, there is direct evidence that inferencing ability is not just a by-product of comprehension, but rather a plausible cause (Cain & Oakhill, 1999). Surprisingly though, studies show little is being done to improve inference skills in early intervention programs (van Kleeck, 2008).

Adult's inferences with children have customarily been examined using four levels of abstraction (van Kleeck et al., 1997; Hammett, van Kleeck, & Huberty, 2003), which have been adapted from the original version by Blank, Rose and Berlin (1978).

- Level 1 refers to utterances that require **matching perception**, such as "comments or questions that involve labeling, locating, or noticing an object or character".
- Level 2 refers to utterances that involve **integration of perception**, such as "describing characteristics of an object", character, or actions in a scene.
- Level 3 utterances are those that **infer about perception**, such as "recall prior information, make comparisons and judgments, or summarize information from the story".
- Level 4 utterances involve **reasoning about perceptions**, such as "making predictions, defining words, and providing explanations that go beyond the story".

Levels 1 and 2 refer to literal or concrete language, whereas levels 3 and 4 refer to inferential or abstract language.

Researchers have found that parent's use of abstract language is related to children's later language development and children's participation during storybook interactions (van Kleeck et al., 1997). Additionally, in their study with preschool teachers, Zucker, Justice, Piasta and Kaderavek (2010) found that the levels of abstraction used in teachers' questions significantly predicted children's responses at the same level. There is also experimental evidence for the benefits of engaging young children in inferential talk. In their intervention study in Head Start classrooms with low-income preschoolers, teachers were trained in specific book-reading and conversation strategies, such as the use of inferential language and open-ended questions through a method known as dialogic reading. Results of the intervention program suggest that giving

opportunities to engage in conversation supports vocabulary development (Wasik & Bond, 2006).

It may also be meaningful to look at, not only the amount of, but also the different types of inferences that mothers and children use while book reading. When examining children's inferences, researchers have typically looked at categories of inferences made (McGinnis, Goss, Tessmer, & Zelinksi, 2008). In the existing literature, research has primarily focused on goal and causal inferences due to their importance in narrative comprehension. Even as preschoolers, children are aware of and able to answer questions about goals and causality. Inferences about goals help the child understand characters' motivations for their actions within a narrative. Numerous studies have shown that preschooler's inferences about a character's goals uniquely predicts both their narrative comprehension (Kendeou et al., 2008) and ability to later recall the stories (Lynch & van den Broek, 2007). Tompkins et al. (2012) found that, of all the various types of children's inferences studied, specifically three types were significantly related to story comprehension: characters' goals, actions that achieved those goals, and character states. Also uniquely significant to narrative comprehension are causal inferences in which the children relate events and actions with their corresponding outcomes. In another study by van den Broek, Lorch and Thurlow (1996), four- to six-year-olds who made more causal connections were better able to recall events within a story.

This study will utilize both approaches (levels and categories) for a more detailed analysis of inferential language use. In addition to further coding the inferences, we also differentiated between mother's questions (both closed- and open-ended) and statements. Open-ended questions are defined as questions that require more than a yes–no or a one-word response. For example, "What is happening in this picture?" or "What is this character doing?" instead of

closed questions, such as "What color is his hat?" or "Do you like this book?". In one experimental study, Head Start teachers were trained in strategies to increase opportunities for language and vocabulary development with young children through the use of open-ended questions. At the end of the training period, children in the intervention classrooms performed significantly better on both receptive and expressive vocabulary. Additionally, 70% of the intervention teachers significantly changed the way they talked to and willingly listened to children during book reading, increasing their use of open-ended questions (Wasik & Bond, 2006). In their study on teacher's use of literal and inferential questioning, researchers found that preschoolers gave an elaborated response to teachers' level 4 questions. By contrast, the same children were unlikely to have an extended response when teachers asked the most basic literal questions (Zucker et al., 2010).

In summary, adults' use of inferential language is related to children's reading *comprehension* and preschoolers' spontaneous *production* of inferences is related to their story *comprehension*. However, researchers have not yet explored whether adults' inferential language is related to preschoolers' production of inferences. Thus, the purpose of the current study is to examine mothers' inferential language during a shared book-reading activity with their preschoolers and children's later story comprehension and spontaneous production of inferences in a short-term 6-month longitudinal study.

The hypotheses of this study include: 1) children's vocabulary, story comprehension, and inferential language will be significantly correlated, 2a) mothers' levels of abstraction will correlate with children's levels of abstraction within the same book, particularly mothers' open-ended questions, and 2b) mothers' inference categories will correlate with children's inference categories within the same book, 3a) mothers' use of inferential language will predict how well

children perform on vocabulary, story comprehension, and inferential language (levels) 6 months later, 3b) mothers' use of inferential language will predict how well children perform on inferential language (categories) 6 months later.

Method

Participants

At Time 1, mothers and their 3- to 5-year-olds were recruited to participate in a larger study examining mother-child interactions and children's language and literacy skills. Only those tasks relevant to the current hypotheses are presented here. Parents were asked if they could be contacted for future studies; those who consented were contacted 6 months later at Time 2 to participate in similar activities. Consent forms were returned for 84 mother-child dyads; 15 dyads were excluded for a variety of reasons, such as not speaking English at home or inability to contact mothers. Of these 69 mothers who participated at Time 1, 52 mother-child dyads consented to participate at Time 2. Data are reported only for these 52 dyads. At Time 1, mothers ranged in age from 20 to 40; children ranged in age from 3.5 to 5.7 years old with a mean of age 4.46 years old (*SD*=0.47). The racial structure of the children included 80% Caucasian, 15% African American, 3% Hispanic/Latino, and 2% Asian Americans. The gender of child participants was equally divided between male and female. At both time points, dyads were given their choice of two children's books or a twenty-five dollar gift certificate.

General Procedure

At Time 1, mothers and children were observed engaging in a storybook interaction, from which the inferences of the mothers and their children were assessed. At Time 2, children's language skills were assessed, to include receptive vocabulary, story comprehension, and a story

generation task, from which children's inferences were assessed. The mother-child storybook interaction and children's story generation were recorded for later transcription. Assessments were conducted at a variety of locations depending on the mothers' preference, including children's child care centers, families' homes, an on-campus laboratory, or in a few cases, a private meeting room in a public library.

Mother-Child Storybook Interaction

At Time 1, Mother-child dyads were observed reading the book *Mr. Peek and the Misunderstanding at the Zoo* (Waldron, 2010). This book was selected because it has a typical story line, with a main character who deals with a problem and who finds the solution in the end. However, a broader appreciation of the story requires the reader to consider multiple characters' perspectives in order to grasp why the plot unfolds as it does. Therefore, this book provided plenty of opportunities for discussion beyond the text.

Children's Language Skills

At Time 2, children's receptive vocabulary, story comprehension, and story generation were assessed in that order. Receptive vocabulary scores were based on the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007). Children's story comprehension was assessed by an experimenter who read the book *Mr. Duck Means Business* (Sauer & Mack, 2011), stopping at 10 predetermined points to assess both children's literal and inferential understanding of the story. The literal questions asked included: initiating event, goal, outcome resolution, characters, and setting. The inferential questions asked included: dialogue, theme, causal inference, feelings, and prediction. Scores for each question ranged from 0-2, for a total score of 20 points. This task was adapted from similar methods using different storybooks (Paris & Paris, 2003; Tompkins, Zucker, Justice & Binici, 2013). Finally, children were asked to narrate the

wordless storybook *Frog Goes to Dinner* (Mayer, 1992) in order to assess children's ability to spontaneously produce inferences. Children were given the directions: "This book is called Frog Goes to Dinner. It doesn't have any words in it so I need your help to tell the story." Aside from a specific prompt on the first page, children were given only open-ended prompts such as "What is happening here?" in order to assess children's ability to spontaneously generate inferences on their own. Raw scores from all assessments were used for analyses.

Transcription and Coding

All mother-child storybook interactions and children's story generation tasks were transcribed verbatim using the CHILDES system (MacWhinney, 2000). Mothers' and children's narratives were coded for each independent clause (i.e., subject + verb + complement structures). All utterances other than the text in the book (which would be all utterances for the wordless *Frog* stories) were coded for inferences based on two coding schemes. First, all utterances were coded for level of abstraction; second, all inferential utterances were also coded in terms of the category of inference (e.g., character emotion). Examples of each level of abstraction are provided in Appendix 1. Mother's extratextual utterances were further coded into statements, open-ended questions, and closed (i.e., yes/no) questions. Children's utterances were further coded into yes/no responses and elaborative utterances (i.e., utterances that went beyond yes/no responses). The coding scheme used in this study was adapted from Hammett et al. (2003).

After all the *Mr. Peek* and *Frog* stories were coded according to the 4 levels, levels 3 and 4 were further coded for category of inferences. There were originally 11 categories in total (see Appendix 2), but for the purposes of this study, we reduced the number of inference categories to 5 by excluding categories for which there were very few utterances of that type (a mean of less than .05) in either mother-child storybook interactions or the story generation task. The 5

remaining inference categories that were examined include: character activities, causal statements, character states, character dialogue, and character emotions. Please see Appendix 2 for the categories of inferences and examples of each. This coding scheme is adapted from Kendeou et al. (2008) and McGinnis et al. (2008).

Results

Data from two mother-child storybook interactions were excluded; one dyad did not complete the book and the child of the other dyad was not present for most of the book. Data from one story generation task were excluded because of experimenter error. Data were first inspected for outliers. All values that were above or below 2.5 standard deviations of the mean were excluded. Next, each variable was inspected to determine whether it was normally distributed. Several variables were not; because several transformations of the data did not result in a normal distribution, Spearman correlations were used for all analyses.

Children's standard scores on the PPVT ranged from 66 to 146, with a mean of 99.27 (*SD*=18.68). Children's performance on the story comprehension assessment ranged from 4 to 17 (out of 20), with a mean of 11.63 (*SD*=3.13). Table 1 shows the descriptive data regarding the levels of abstraction for mothers and children during shared book reading at Time 1 and children's levels of abstraction during the story generation task at Time 1. Table 2 shows the descriptive data regarding the categories of inferences for mothers and children from these same tasks.

My first hypothesis was that children's vocabulary, story comprehension and inferential language would be significantly correlated. As table 3 demonstrates, children's vocabulary and story comprehension were positively correlated, and story comprehension was positively

correlated with children's total number of inferences during the story generation task. The child's age was also considered as a variable as there was a relatively wide distribution of ages. Age was significantly correlated with all three of the children's Time 2 assessments.

Hypothesis 2a was that mothers' levels of abstraction will correlate with children's levels of abstraction within the same book, particularly mothers' open-ended questions. As table 4 indicates, results showed several significant correlations between mothers' open-ended questions and children's elaborative responses at the same level of abstraction. There were also several significant correlations between mothers' closed questions and children's yes/no responses at the same level of abstraction.

My next related hypothesis (2b) was that mothers' inference categories would correlate with inference categories within the same book. Originally, all inferences were coded according to 11 categories; however, for the purposes of this study, we reduced the number of inference types by excluding categories for which there were very few utterances of that type (a mean of less than .05) in either mother-child storybook interactions or the story generation task. The following are the categories that were eliminated from data analysis: action, goal, place, definition, evaluation, and object. The remaining 5 categories included character activities, causal statements, character states, character emotions, and character dialogue. As table 5 illustrates, all mothers' and children's categories were significantly correlated within the mother-child storybook interaction.

Hypothesis 3a was that mothers' use of inferential language would predict how well children perform on vocabulary, story comprehension, and inferential language (levels) 6 months later. For this analysis, levels of abstraction were collapsed to reduce the number of correlations (e.g., all of mothers' level 1 utterances were collapsed rather than examining questions and

statements separately). Children's age was controlled for because age was a significant predictor of all of children's language variables. As shown in Table 6, Partial Spearman correlations controlling for child's age showed that mother's use of inferential language (both level 3 and level 4) predicted how well children performed on vocabulary 6 months later at Time 2. In regards to the levels of abstraction correlates, only mother's use of level 2 language (integrating information and describing characteristics or actions in a scene) was correlated with children's use of the same level 2 language 6 months later. The other levels of abstraction used by mothers and preschoolers were not significantly correlated. Another part of my hypothesis was not supported by the results: that mothers' use of inferential language would predict how well children perform on the story comprehension task.

My final hypothesis (3b) was that mothers' use of inferential language within particular categories would predict children's use of those same categories during the story generation task performed 6 months later. Table 7 shows that there were no significant correlations between the inference categories controlling for child's age, although the character emotions category was marginally significant ($r = .26, p < .10$).

Discussion

The purpose of this study was to examine mothers' use of different types of language during a shared-book activity with their preschoolers and how this relates to children's later story comprehension and spontaneous production of inferences. Unlike other studies on mothers' use of inferential language (van Kleeck et al., 1997; van Kleeck et al., 2006) that have analyzed the effect on children's literacy skills such as vocabulary and story comprehension, we analyzed mothers' inferential language on children's spontaneous production of inferences on their own.

Whereas previous researchers have found that children's use of inferential language leads to better story comprehension (e.g., Kendeou et al., 2008), they have not looked at what predicts children's use of inferential language. Thus, the current study combines both aspects of previous research on inferencing to analyze factors that may predict children's use of inference.

Regarding my first hypothesis, children's vocabulary and story comprehension scores were correlated. Children's story comprehension scores were also correlated with children's total number of inferences produced in the story generation task. These results confirm that the level of comprehension skills in preschoolers predicts a higher level of vocabulary skills and inferential language abilities. These findings replicate Tompkins et al. (2013), who also found a significant relationship between preschoolers' story comprehension and production of inferences using the same task.

Results showed what one would expect to find regarding hypotheses 2a and 2b based on prior research (Zucker et al., 2010; Wasik & Bond, 2006). Results of hypothesis 2a showed correlations between mothers' open-ended questions and children's elaborative responses within each level of abstraction. Mothers' closed questions and children's yes/no responses were also correlated at the same level of abstraction, with the exception of level 1. This makes sense because open-ended questions are more likely to elicit a more elaborate response, and closed questions are more likely to be answered with a yes or no. Even young children perceive the expected answer to such questions. These correlations suggest that mothers who use more open-ended questions, both literal and inferential will receive a more engaged and expanded response from their child. In regards to hypothesis 2b, all categories of inferences were significantly correlated between the mother and her child. This finding implies that the type of inferential

language that the mother uses will influence the type of inferential language the child uses when they are reading a book together.

The results of my research, in regard to hypothesis 3a, are consistent with prior studies because they suggest that mothers' use of higher-level language (abstraction) will influence their children's later vocabulary skills (van Kleeck et al., 1997). The results did not show a relationship between mothers' inferential language and children's story comprehension scores or use of inferential language in the story generation task 6 months later. Mothers' level 2 utterances did, however, predict children's level 2 utterances during the story generation task (i.e., descriptive language discussing characteristics or actions in the story).

In regard to hypothesis 3b, there were no significant correlations between mothers' inference categories at Time 1 and children's inference categories at Time 2. The only marginally significant correlation was between mothers' and children's talk about characters' emotions. To my knowledge, no other studies have looked specifically at the relationship between the categories of inferential language that mother's use and that children use independently. Therefore, we cannot compare the results of this hypothesis from this study to previous research.

The ability to make inferences is an important foundation for story comprehension. In fact, early detection of inference making has been shown to predict later story comprehension skills (e.g., Cain & Oakhill, 1999; Kendeou et al., 2009). Understanding how parent-child interactions are related to preschoolers' story comprehension has practical implications, considering the relationship between inference making and later reading comprehension skills (e.g., van Kleeck et. al, 1997). This knowledge will hold relevance to the current research being conducted in the area of improving emergent literacy skills. It will provide useful information for

educators and parents who want to know specific strategies that will help prepare young children as they emerge as future readers. Results of the current study support the use of strategies such as inferential language to improve children's vocabulary skills and mother's use of open-ended questions to receive a more elaborative response from her preschool-aged child.

Preschoolers' ability to actively produce inferences during a story is important because of the relationship between inference making and reading comprehension in older children (e.g., Cain, Oakhill, & Bryant, 2004). Thus, if researchers can identify certain behaviors that adults engage in during book reading that are related to preschoolers' production of inferences, researchers can target such skills in interventions and in the classroom.

Limitations

A limitation of this study is that the children's language and literacy skills were examined 6 months after the mother-child book reading session. Previous studies have found that mothers' inferential talk does not predict children's immediate language skill while studies with 1-year follow-ups find significant results (e.g., van Kleeck et al., 1997). Researchers argue that it takes children time to internalize these skills. It may be that the intermediate 6-month time frame was too short for significant relationships to emerge. Another limitation is that the design of the study is correlational. Thus, I cannot argue that mothers' use of inferential language causes children to have better vocabulary skills.

There were no significant correlations between mothers' inference categories at Time 1 and children's inference categories at Time 2. A possible explanation for these results may be that children of preschool age can relate to this depth of language as it is being pointed out and discussed, but are not yet developed enough to produce such inferences in the absence of a close intimate relationship with the person with whom they are interacting (the experimenter). It may

also be that the two books were not similar enough in content to allow for significant correlations to emerge (e.g., mothers rarely discussed goals in the Mr. Peek book). It may be that mothers' inferences better predict children's *change* in inferential language (van Kleeck et al., 1997).

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Table 1

Descriptive Data – Levels of Abstraction

Variables	**Range**	**Mean**	**SD**
Mothers' JSR Level 1 Closed Questions	0-10	0.84	1.66
Mothers' JSR Level 2 Closed Questions	0-6	1.52	1.64
Mothers' JSR Level 3 Closed Questions	0-12	2.84	2.79
Mothers' JSR Level 4 Closed Questions	0-9	1.40	1.78
Mothers' JSR Level 1 Open Questions	0-13	1.98	3.13
Mothers' JSR Level 2 Open Questions	0-11	2.52	2.61
Mothers' JSR Level 3 Open Questions	0-9	1.26	1.82
Mothers' JSR Level 4 Open Questions	0-10	1.34	2.02
Mothers' JSR Level 1 Statements	0-18	4.18	4.21
Mothers' JSR Level 2 Statements	0-22	4.62	4.04
Mothers' JSR Level 3 Statements	0-19	5.78	4.45
Mothers' JSR Level 4 Statements	0-16	3.78	3.93
Children's JSR Level 1 Yes/No Responses	0-2	0.18	0.44
Children's JSR Level 2 Yes/No Responses	0-3	0.44	0.86
Children's JSR Level 3 Yes/No Responses	0-4	0.86	1.13
Children's JSR Level 4 Yes/No Responses	0-4	0.56	0.91
Children's JSR Level 1 Elaborative Responses	0-28	4.22	5.82
Children's JSR Level 2 Elaborative Responses	0-18	3.02	3.37
Children's JSR Level 3 Elaborative Responses	0-12	1.74	2.79
Children's JSR Level 4 Elaborative Responses	0-5	0.88	1.17
Children's SG Level 1 Utterances	0-9	2.37	2.14
Children's SG Level 2 Utterances	1-22	10.75	4.53
Children's SG Level 3 Utterances	2-36	11.69	7.36
Children's SG Level 4 Utterances	0-14	3.18	2.9
Children's SG Total Literal	2-24	13.12	5.17
Children's SG Total Inferential	2-46	14.86	8.9

Note. JSR=Joint Storybook Reading at Time 1; SG=Story Generation at Time 2.

Table 2

Descriptive Data – Categories of Inferences

Variables	**Range**	**Mean**	**SD**
Mothers' JSR Inference: character action	0-1	0.02	0.14
Mothers' JSR Inference: character activity	0-7	1.50	1.94
Mothers' JSR Inference: causal statement	0-13	3.68	3.35
Mothers' JSR Inference: character state	0-17	4.48	3.49
Mothers' JSR Inference: definition	0-14	1.88	3.05
Mothers' JSR Inference: character dialogue	0-8	0.66	1.36
Mothers' JSR Inference: character emotions	0-14	2.82	3.19
Mothers' JSR Inference: evaluation	0-7	1.72	2.03
Mothers' JSR Inference: goal	0-2	0.12	0.39
Mothers' JSR Inference: object	0-6	0.70	1.20
Mothers' JSR Inference: place	0-3	0.46	0.81
Children's JSR Inference: character action	0-1	0.02	0.14
Children's JSR Inference: character activity	0-7	0.40	1.11
Children's JSR Inference: causal statement	0-5	0.74	1.12
Children's JSR Inference: character state	0-7	0.84	1.41
Children's JSR Inference: definition	0-4	0.34	0.75
Children's JSR Inference: character dialogue	0-2	0.14	0.41
Children's JSR Inference: character emotions	0-13	0.88	2.05
Children's JSR Inference: evaluation	0-5	0.51	0.98
Children's JSR Inference: goal	0-1	0.02	0.14
Children's JSR Inference: object	0-2	0.16	0.43
Children's JSR Inference: place	0-2	0.20	0.46
Children's SG Inference: character action	0-7	1.22	1.24
Children's SG Inference: character activity	0-8	2.16	1.82
Children's SG Inference: causal statement	0-7	0.94	1.39
Children's SG Inference: character state	0-11	2.43	2.52
Children's SG Inference: definition	0-4	0.20	0.72
Children's SG Inference: character dialogue	0-14	2.29	3.07
Children's SG Inference: character emotions	0-15	2.76	3.41
Children's SG Inference: evaluation	0-2	0.29	0.54
Children's SG Inference: goal	0-4	1.63	1.17
Children's SG Inference: object	0-3	0.49	0.83
Children's SG Inference: place	0-5	1.25	1.07

Note. JSR=Joint Storybook Reading at Time 1; SG=Story Generation at Time 2.

Table 3

Spearman Correlations among Children's Age and Time 2 Assessments

	Child's Age	Vocabulary	Story Comprehension	Story Generation Total Inferences
Child's Age	--			
Vocabulary	.63**	--		
Story Comprehension	.37**	.29*	--	
Story Generation Total Inferences	.32*	.17	.34*	--

Note. *$p < .05$, **$p < .01$

Table 4

Correlations between Mothers' and Children's Levels of Abstraction during Mother-Child Book Reading

		Mothers' Utterances		
	Children's Responses	Closed Questions	Open-Ended Questions	Statements
Level 1	Elaborative	.36*	.49**	.70**
	Yes/No	.03	.53**	.18
Level 2	Elaborative	.40**	.55**	-.07
	Yes/No	.52**	.26	-.01
Level 3	Elaborative	.15	.36*	.30*
	Yes/No	.51**	.10	.28
Level 4	Elaborative	.40**	.60**	.30*
	Yes/No	.50**	.03	.32*

Note. *$p < .05$, **$p < .01$.

Table 5

Spearman Correlations between Mother's and Children's Inference Categories during Mother-Child Book Reading

	M character activities	M causal statements	M character states	M character dialogue	M character emotions
C character activities	.53**	.32*	.19	.16	.27
C causal statements	.23	.34*	-.09	.08	-.07
C character states	.30*	.21	.34*	.43**	.29
C character dialogue	-.22	.02	.13	.45**	.12
C character emotions	-.13	.05	.33*	.29*	.50**

Note. M=mother inferences; C=child inferences; *$p < .05$, **$p < .01$.

Table 6

Partial Spearman Correlations between Mothers' Levels of Abstraction at Time 1 and Children's Time 2 Assessments Controlling for Children's Age

	M1	M2	M3	M4
Vocabulary	-.16	.25	.32*	.43*
Story Comprehension	-.07	.00	.01	.02
Story Generation Level 1	.22	.04	-.07	-.16
Story Generation Level 2	-.15	.31*	.13	.28
Story Generation Level 3	-.21	-.13	-.02	.07
Story Generation Level 4	-.06	-.15	.02	-.05

Note. M1 = mothers' level 1 utterances; M2 = mothers' level 2 utterances; M3= mothers' level 3 utterances; M4 = mothers' level 4 utterances; *$p < .05$, **$p < .01$.

Table 7

Partial Spearman Correlations between Mothers' and Children's Inference Categories Controlling for Age

	M character activities	M causal statements	M character states	M character dialogue	M character emotions
SG character activities	-.02	-.19	-.01	.06	.04
SG causal statements	.07	-.03	-.08	.03	-.09
SG character states	-.12	-.04	-.13	-.13	-.10
SG character dialogue	-.10	.15	.04	.03	-.12
SG character emotions	-.02	-.09	.08	.27	.26

Note. M=mother's inferences SG= children's inferences in story generation task; *$p < .05$, **$p < .01$.

Appendix 1

Definitions and Examples of Coding for Levels of Abstraction

Levels of Abstraction	Definition	Example
Level 1: Matching Perception	• Label an object or person • Describe the location of an object or character; ask a question regarding location • Notice or direct attention to a pictured object • Rote counting	M: That's a fish and there is a kitty cat. C: The boy is standing in front of the mirror. C: There is a frog, a turtle, and a dog.
Level 2: Integration of Perception	• Describe characteristics of objects or characters (size, shape, color, quantity, parts) • Describe or notice actions that are immediately perceptual in text or pictures	M: Look the elephants are wrinkly. C: *The frog jumped* into the saxophone.
Level 3: Infer about Perception	• Make inferences • Recall information presented earlier • Make judgments or evaluations • Make an interpretation of what a character is thinking or feeling • Identify differences or similarities between things in book	M: He's feeling sorry for himself. M: Look they're not crying anymore. C: There was *something wrong* with his instrument. C: One of the band members looks *scared*.
Level 4: Reasoning about Perception	• Make predictions • Provide factual knowledge or definitions • Provide explanations	M: Now they feel better because they know that he doesn't think anything bad about them. C: There's something stuck inside the trumpet.

Note: Coding categories adapted from Blank et al. (1978).

Appendix 2

Definitions and Examples of Coding for Categories of Abstraction

Inference Type	Definition	Example of Inference (T1-*Mister Peek*)	Example of Inference (T2-*Frog Goes to Dinner*)
Goal	Motives of an agent	Are *they trying* to make him look happy or sad?	*The waiter is trying to catch the frog*.
Actions	How an agent's goal is achieved		The boy is *getting dressed* to go out to dinner.
Causal Statements	Connection between the current event and the previous context	That's why the button fell off.	The guy couldn't play the saxophone *because there was a frog in it*.
Character State	A character's thoughts, perceptions, role (e.g., mother), traits, or physical characteristics	Oh my goodness that *hippo thinks that the zookeeper is saying that she's fat!*	They *thought* it was so funny.
Character Dialogue	A character's utterance	*They're saying &=gasps oh no nobody likes us*.	The boy tells the waiter *he wants his frog back*.
Character Activities	A character's activities that are not part of a goal	*He left his keys in this jacket*.	The man *falls* in the drum.
Character Emotions	The feelings experienced by a character in response to an event	Now the monkeys are *happy*!	The frog was *scared* that she was going to eat him.
Place	Mentioning a place or setting	The little boy is *at home* raking the leaves.	The little boy and his family arrive at the *restaurant*.
Object	Mentioning a state or property of an object	Remember *the jacket was too little?*	*There was something wrong with his instrument*.
*Evaluations	Providing an evaluation of the story	He's causing all kinds of trouble, isn't he?	
*Factual Knowledge/ Definitions	Providing a definition or Factual Knowledge	*Remark means the thing that he said*.	

* Categories only used for T1.
Codes adapted from Kendeou et al. (2008) and McGinnis et al. (2008).